CHAPTER 8

ENVIRONMENTAL POLLUTION

Several laws have been enacted in the past to control both air and water pollution, but, for various reasons, they were largely ineffective. With increased awareness, however, that our ecological system was seriously endangered by pollution, Congress on 1 January 1970 passed the National Environmental Policy Act of 1969, and followed in April with the Environmental Quality Improvement Act of 1970. In these two Acts Congress declared a national policy for enhancement of environmental quality and assigned responsibilities for carrying out this policy.

Briefly, these Acts require the Federal Government, in cooperation with State and local governments, to use all practicable means to create and maintain conditions for a compatible existence between humans and nature. Each Federal department or agency involved in any action that affects the environment is required to observe all existing laws governing the control of pollution. All future construction is to be designed with pollution control in mind.

POLLUTION CONTROL REGULATIONS

In 1899 Congress passed a law prohibiting the discharge of refuse in navigable waters of the United States. The Oil Pollution Act of 1924 prohibited the discharge of oil of any kind (fuel oil, sludge, oily wastes, etc.) into the navigable waters. These Acts formed the basis for Article 1272, Navy Regulations 1948, which forbids the discharge of oil or refuse into inland or coastal waters. The Oil Pollution Act of 1961 prohibits the discharge of oil or oily mixtures, such as ballast, within specific zones bordering coastal nations. These prohibited zones extend a minimum of 50 miles seaward from the nearest land and out to 150 miles in some areas. Most countries bordering the Mediterranean Sea, for example, have a zone of 100 miles; the Australian zone extends 150 miles around most of the continent. Although this Act does not specifically apply to naval vessels, its provisions were incorporated into Article 1272 the following year. (The Act of 1961 is a ratification of an international agreement known as the Convention for the Prevention of Pollution of the Sea by Oil, 1954. Proposed amendments would abolish prohibited zones and extend oil dumping prohibitions to all ocean areas).

The Oil Pollution Act of 1924 was repealed by the Water Quality Improvement Act of 1970 (Public Law 91-224). (The Acts of 1899 and 1961 remain in effect, as does Article 1272 of Navy Regulations.) This Act prohibits the noncasualty discharge of any type of oil from any vessel, onshore facility, or offshore facility, into or upon navigable waters of the United States, adjoining shorelines, or waters of the contiguous zone (12 miles). Other features of the Act provide for the control of hazardous substances other than oil and for the control of sewage discharges from vessels.

The Clean Air Amendments of 1970 (Public Law 91-604) set goals for the reduction of pollutant emissions from stationary sources and from motor vehicles. New stationary sources that burn fossil fuels must conform to emission standards as determined and promulgated by the Environmental Protection Agency (EPA).

Guidelines for preventing, controlling, and abating air and water pollution are contained in the Navy's environmental quality program, OPNAV Instruction 6240.3. In general, the Navy is charged with ensuring that all facilities (ships, aircraft, shore activities, vehicles, etc.) are designed, operated, and maintained in conformance with standards set forth in the two Acts. Some of the most pertinent requirements of this instruction follow.

Municipal regional waste collection and disposal systems are to be used by shore activities whenever possible. All materials (solid fuels, petroleum products, chemicals, etc.) are to be handled so as to prevent or minimize pollution of the air and water. Resources are to be conserved by reprocessing, reclamation, and reuse of waste materials whenever feasible. Ships must use port disposal facilities for all wastes prior to getting underway and upon return to port. Oil products will not be discharged within any prohibited zone, and trash and garbage will not be discarded within 12 miles of shore; waste materials normally will not be burned in open fires. Sinking agents and dispersants will not be used for combating oil spills except when necessary to reduce hazard to human life, or when there is a substantial fire hazard.

In striving to meet requirements of the Clean Air and Water Quality Improvement Acts, the Navy has instituted several ongoing programs, some of which are in operation; others are being tested and evaluated. For example, completely enclosed firefighting training facilities from which no smoke escapes are now in operation. Aboard ship, the shift from Navy standard fuel oil to distillate will greatly reduce air pollution because of the distillate's low sulfur content. (It also is a cleaner-burning fuel.) Undergoing evaluation are several models of self-contained shipboard sanitary treatment systems that eliminate the discharge of polluted sewage.

OIL POLLUTION

The Navy, as required by a National Contingency Plan, has established a rapid response capability at each of its major naval bases to clean up oil spills emanating from naval vessels or shore facilities. At many naval activities, these capabilities include contractors, other Federal agencies, and municipal, civic, and other local and volunteer organizations. To provide adequate equipment for this purpose, the Navy, under the direction of the Naval Facilities Engineering Command, is pursuing a multi-year technical development and procurement program at the Naval Construction Battalion Center, Pt. Hueneme, CA. This program has already resulted in significant improvements in equipment and cleanup techniques. As new methods of improvements are developed, this information is used in equipment procurement and operator training programs.

RESPONSIBILITIES

The Chief of Naval Operations (CNO) issued OPNAVINST 6240.3E, which assigned specific responsibilities to the fleet commanders, area coordinators, the Chief of Naval Material, and other major claimants with respect to oil spill cleanup.

Area Coordinator

Area Coordinators assume the role of, or designate, on-scene coordinators and on-scene commanders for navy oil spills. They are responsible for planning contingency operations and for coordinating, with local commands and appropriate local, state, and federal agencies, the implementation of these contingency plans. They are also responsible for coordinating and implementing the development of effective and comprehensive contingency plans for naval activities within their areas.

On-Scene Coordinator

The on-scene coordinator (OSC), person predesignated by the Area Coordinator, is responsible for making all reports required by OPNAVINST 6240.3E and by any local instruction pertaining to reporting oil spills. Final message reports must be submitted within 24 hours after securing a cleanup operation.

When a report of a navy polluting incident is received, OSC must obtain full information concerning,

(1) Ship or activity involved;

(2) The location of the spill;

(3) The time and date of the spill, if known;

(4) The amount (in gallons) and type of oil spills, or the amount (pounds/kilograms) and type of hazardous substance(s) spilled;

(5) The primary and secondary causes of the spill, if known;

(6) The corrective action taken to stop, contain, and prevent recurrence by the reporting ship or activity, if any;

(7) The assessment of the help required (containment equipment and/or clean up equipment).

The OSC must also (1) designate an on-scene commander (OSCDR), (2) notify the personnel concerned with cleaning up the pollutant, and (3) take charge at the scene until the arrival of the OSCDR.

On-Scene Commander

The OSCDR reports directly to the OSC and assumes the responsibility for directing the manpower and equipment at the scene of the pollution, and utilizes all available resources to quickly remove the pollutant and to restore the environmental quality. Upon notification of a navy spill in local waters, the OSCDR takes immediate action to contain or isolate the spill by utilizing duty section personnel or personnel assigned to a spill recovery team and their equipment.

The OSCDR's responsibility is to determine the source of the spill, contain it, commence cleanup operations, and eliminate it.

If the navy spill occurs after working hours the OSCDR executes the recall bill, if necessary.

SPILL PHASES

When oil is spilled, it triggers a series of actions that are common to all spills and which have been categorized into the following operational phases.

1. Discovery and notification.
2. Evaluation and initiation of action.
3. Containment and countermeasures.
4. Recovery, mitigation, and disposal.
5. Cleaning and repositioning equipment.
6. Documentation and cost recovery.

Spill phases do not necessarily follow in sequence, but may and generally do, overlap. Figure 8-1 shows this overlap and summarizes some of the actions in each phase of an oil spill. Spill control operations can last anywhere from a few hours to several weeks and individual spills do not require the same degree of implementation for all the operational phases.

Phase I—Discovery and Notification

Discovery of an oil spill usually results from one or more of the following: (1) casual observation by personnel or the public, (2) result of monitoring and surveillance program, or (3) report made by the spiller. Whatever the mode of discovery, all Navy related spills must be reported.

Phase II—Evaluation And Initiation of Action

Upon notification and inspection of the spill, the Navy OSCDR must evaluate the following: (1) magnitude and severity of the spill, (2) potential impacts of the spill including hazard to life or property, (3) available response time, and (4) capability of local resources to handle the spill. Based upon this evaluation, the OSCDR should initiate local containment action and notify the Navy OSC. The OSC may either alert Regional Response Teams (RRT) or request assistance for spills which are beyond the local Navy response unit capability. The OSC will also evaluate the effectiveness of measures applied to the spill and maintain a detailed log of spill related activities. Spill samples should be taken as soon as possible after the spill and analyzed in accord with acceptable procedure. Data should be recorded for possible future use.

Phase III—Containment And Countermeasures

Containment and countermeasures are positive actions taken to limit the continued spread and migration of the spill and to stop the flow at the source. These steps are the first corrective actions to be taken, and should be initiated as soon as possible after a spill is discovered.

COUNTERMEASURES.—Typical countermeasures include:

1. The isolation and evacuation of the spill area to protect life or health.
2. The "Shut off" activities at the source of the spill. These may range from simple valve realinement to extensive salvage operations. Ruptured tanks, for example, may be sealed with chemicals which foam in place and form reliable seals.

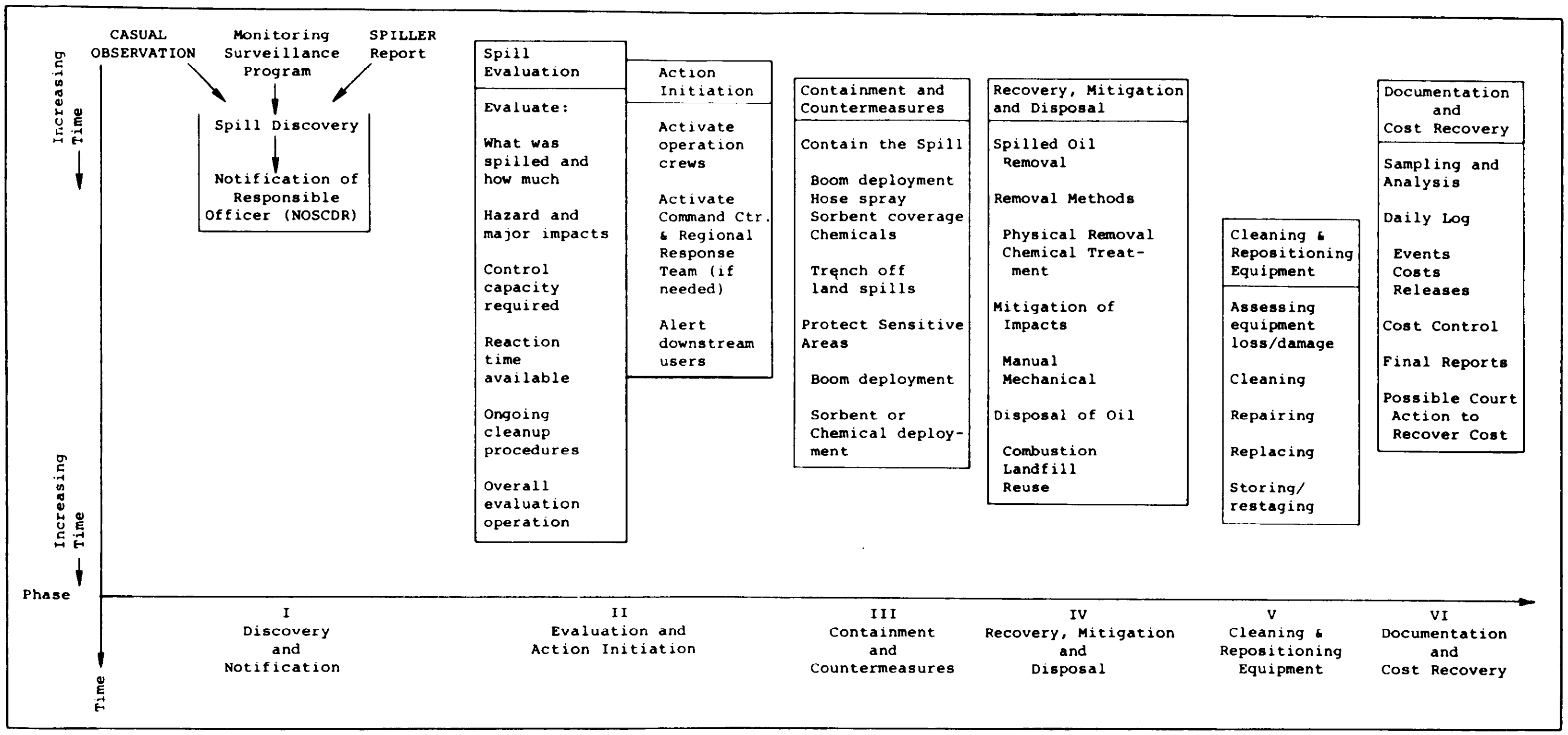

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Figure 8-1.-Operational Phases in an Oil Spill.

3. The placing of booms or other physical or absorbent barriers to prevent contact of the spill with areas of sensitive beneficial uses such as parks; estuaries, tributary streams, or water supply intakes.

4. The preplanned construction of trenches or dikes to isolate potential spill areas on land.

CONTAINMENT.—Containment is the critical first step of any coordinated spill cleanup activity. The rapidity and effectiveness with which it is applied will limit the adverse impacts of the spill on other beneficial uses of the affected water or land area. Table 8-1 summarizes some of the containment methods available.

Table 8-1.—Containment Methods

Type of System	Principle of Operation	Advantages	Disadvantages
Air Barriers	Subsurface bubbling to create upswelling of water surface	Do not impede vessel movement	Are costly to install and maintain. Are limited by environmental factors (wind, current).
Piston Film or Herder Chemicals	Surface tension phenomenon	Can be easily applied. Small dose required.	Only provides limited containment for a matter of hours. Government approved products must be used.
Booms	A physical barrier	Can be deployed quickly. Are physical barriers.	Work best in calm waters. May be used in limited currents and waves.
Hose Spray	Turbulent barrier to oil	Can be rapidly applied	Is limited to use in confined areas and calm water. Is temporary method.
Sorbent Barrier	Both physical barrier and absorbent surface for oil pickup	Can be easily deployed. Can be used for both containment and pickup.	Works best in calm water. Oil is not effectively contained. Slows spreading.

The Navy preferred containment equipment/procedures are piston film chemicals and solid, floating booms.

Piston Film Chemicals.—Piston film chemicals have high surface activity and spread rapidly over the water surface. The spreading force of the chemical is sufficient to overcome the spreading forces of the slick. These chemicals push the oil layer back until it reaches a limiting slick thickness, which the piston film cannot exceed. The oil may be moved ahead of the spreading film toward a collecting or containment device as shown in figure 8-2A, or the piston film may be quickly spread around the periphery of the spill as is shown in figure 8-2B. This technique simply slows down the spreading rate.

Containment Booms.—Containment booms are solid (floating barrier) booms. They are solid, continuous obstructions to the spread or migration of oil spills. Because they are the most effective containment device, they are preferred for use with Navy related spills.

1. Booms are available in various sizes (in 50-foot lengths) which are joined to form a continuous barrier to the oil. Their freeboard must be sufficiently high to prevent the oil from being washed over the boom, and the skirt long enough to prevent oil from being swept under it. Booms are purchased in several height/depth sizes to meet their use requirements under various wind and sea conditions.

2. Booms may be used in either a dynamic (towed) mode or in fixed position. Figure 8-3.I shows a boom being towed in a "vee" configuration in conjunction with a skimming device. The boom directs the oil to the skimming device where it is collected.

3. Booms are also being used to prevent oil from going under the pier and to direct the oil to the skimmer (figure 8-3.II). The slick is moved to the skimmer under the influence of wind and current, or it could be pushed toward the skimmer by hose spray, air jet, or piston film, if necessary.

4. Booms may be anchored in a position that will entrap the oil but leave a channel open for navigation if necessary (figure 8-3.III). The angle at which the boom must be set is important in order to avoid loss of collected oil due to entrapment in the current or from being carried under boom skirts.

5. Figure 8-3 .IV depicts typical use of a boom stretched across a stream. This alinement is feasible in small streams, mild currents, or tidal

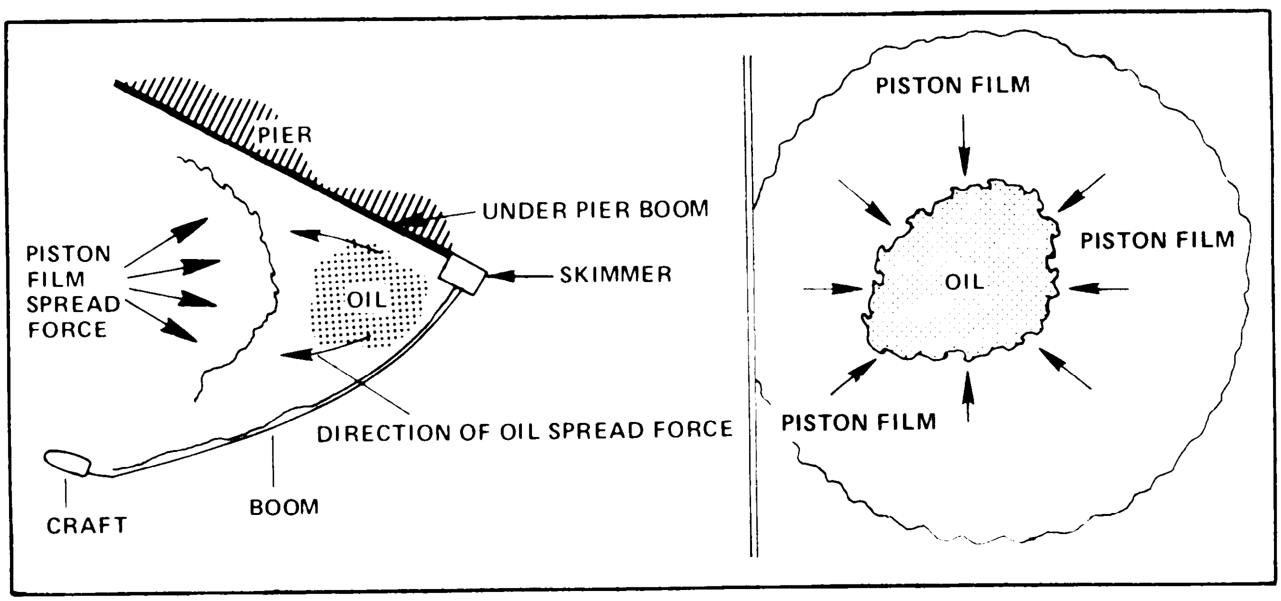

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Figure 8-2.—Use of Piston Film Chemicals.

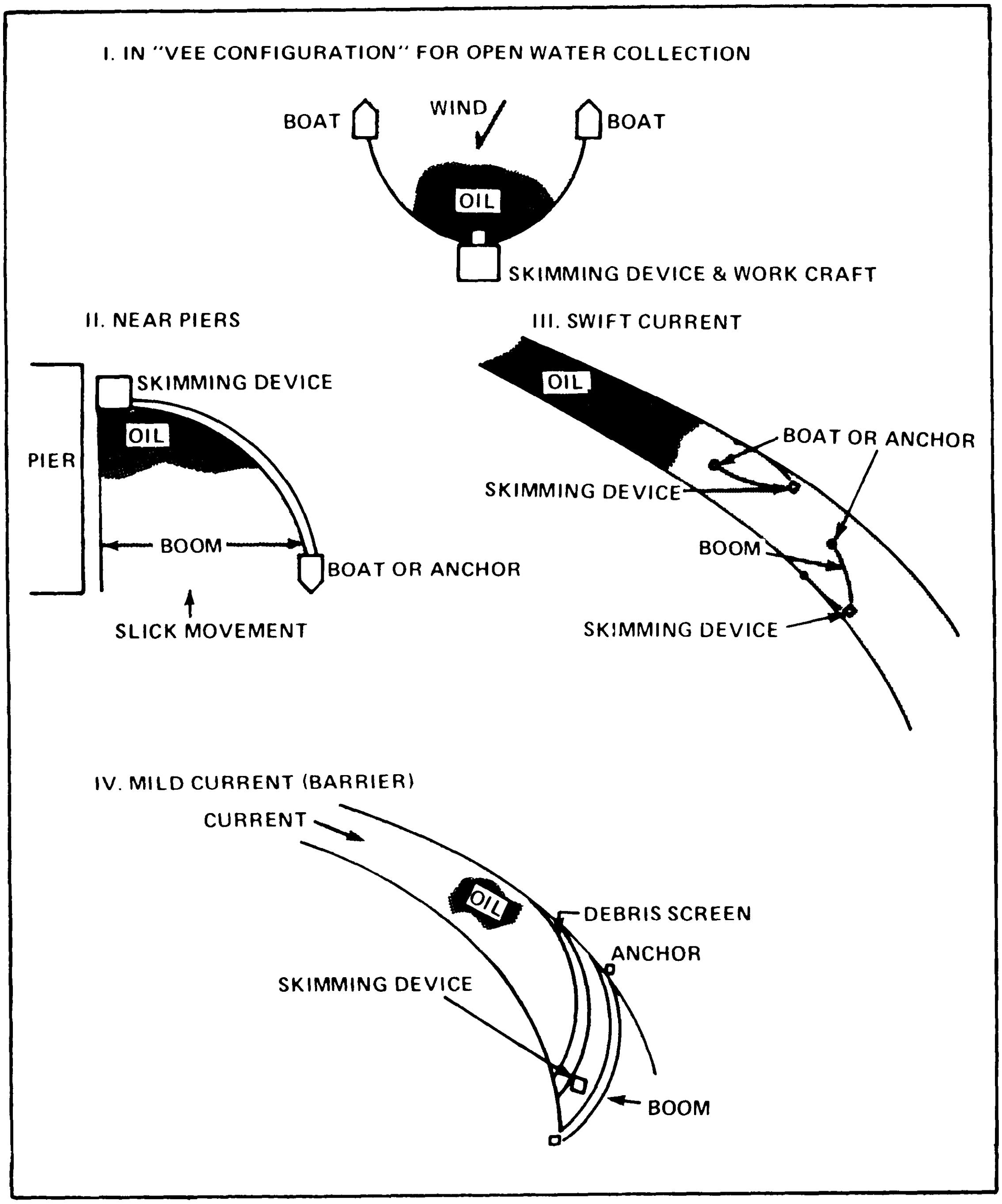

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Figure 8-3.—Typical uses of floating booms.

fluctuations. As depicted, diagonal deployment, in lieu of perpendicular, has been generally found more effective in flowing streams.

Procedures to contain spills on land vary with the amount and type of oil spilled, the type of soil and the terrain. Less viscous oil and more porous soil allow greater and more rapid penetration and lateral migration in the soil. Where feasible, absorbent materials should be applied as soon as possible. Larger spills may require containment devices such as interceptor trenches or collecting pools from which the oil may be pumped.

Spill containment by the use of hose spray can be an effective method in confined areas. This technique is immediately available to ships' forces and provides the earliest form of containment.

Phase IV—Recovery, Mitigation, and Disposal

This phase of an oil spill involves those actions taken to recover spilled oil from the affected environment as well as the monitoring activity associated with determination of the effectiveness of the cleanup operation. It includes those actions taken to mitigate damage cause by the spilled oil, and to dispose of the recovered oil in an environmentally acceptable manner.

REMOVAL.—Removal of spilled oil and oil derivatives may be accomplished several ways, including:

1. Allowing evaporation to take place (gasoline and JP-4).
2. Use of physical removal methods such as manual collection or collection by mechanical equipment, such as skimmers.
3. Removal by fostering biodegradation.
4. Removal by burning.
5. Removal by dispersion (emulsification).
6. Pumping of oil in land spills.

Because of effects which are detrimental to the environment, method 4 is not recommended, or practiced, by the Navy unless there is a direct threat to human life and property. Because of the lengthy reaction time involved, and because of the possibility of toxic by products, method 3 is not practiced nor recommended as a desirable Navy practice. However, it may occur, and can constitute a final polishing action if all the oil is not removed by physical means.

In addition, gelling agents (chemicals which convert the spill to a semisolid mass) or sorbent materials such as straw, polyester plastic shavings, or polyurethane foam may be used to help the subsequent manual or mechanical removal of a spill.

PHYSICAL REMOVAL METHODS.—The Navy prefers physical-mechanical methods of removal, and has designated the types of skimmers for use with Navy spills in various locations.

1. Small Skimmers. The small unit which is designed for use in congested harbor areas is based on the weir principle. The weir depth of these skimmers is controlled by adjusting the flow rate of the attached pump. As the flow rate is increased, the fluid is removed from the rear buoyancy chamber, tipping the unit clockwise, and thereby increasing the weir depth. Decreasing the flow rate allows the buoyancy chamber to fill, tipping the unit counterclockwise, and thereby reducing the weir depth. This unit is most effective in a stationary mode where it is positioned and the oil directed to it.

2. Medium Skimmers. The medium skimmer selected by the Navy is an "endless" belt unit. It is operable from a pier via handheld controls. The principle of operation is shown in figure 8-4. The rotating belt submerges the oil and directs it to the collection well where it concentrates and from which it eventually is pumped to a temporary storage. This principle is entitled the dynamic inclined plane (DIP^{tm}).

3. Large Skimmers. The large skimmer selected for use by the Navy is a larger version of the medium skimmer (DIP^{tm}). This unit is vessel-mounted for use in protected open waters, and is quite effective even in choppy water in that it overruns and submerges the oil layer before collecting it. A rotating belt directs the oil to the collection well.

4. Suction Based Skimmers. Other commercially available units for oil removal are based on suction, either taken directly off the surface of the water or by the development of a submerged vortex. Since these units are highly susceptible to wave action and clogging, they work best in calm,

debris-free waters, and with thick oil layers. They are not extensively used for Navy spills.

5. Sorbent Surface Skimmers. These units use an endless belt, hose, or rotating drum, the surface of which absorbs the spilled oil from the water surfaces. The concept is applied in large, craft-mounted units for large spills and in smaller units using an endless, hose-width belt. The absorbed oil is conveyed to temporary storage tanks where it is squeezed from the belt or wiped from the drum or disc.

6. Manual Methods. Occasionally, manual removal methods are used in the Navy. Manual removal processes involve the physical pickup of the oil from shoreline areas with the use of sorbent materials, pitchforks, and/or shovels. They also include “in water” removal operations such as that mounted for small shipside spills in which the Mark I Spill Control Kit is employed. In this instance, herder chemicals may be used to retard spreading of the spill, and hand-held polyurethane absorbent pads or “mops” are used to “sorb” and remove the oil. The pads are squeezed out with conventional mop wringers.

Chemical Removal Methods.—Chemicals should not be used to emulsify, disperse, solubilize, or precipitate oil whenever the protection or preservation of freshwater supply sources, major shellfish or finfish nurseries, harvesting, grounds, passage areas, or beaches is a prime concern.

Such chemicals should only be used in those surface water areas and under those circumstances where preservation and protection of water related natural resources is judged not to be the highest priority or where a choice as to resource preservation may make the use of such materials a necessary alternative. When chemical compounds are used in connection with oil cleanup, only those compounds exhibiting minimum toxicity toward aquatic flora and fauna should be used. The EPA is now developing, and will soon issue, a standard procedure for determining the toxicity of such chemicals.

Now let’s describe some of the chemical removal methods used.

1. Dispersants. Dispersants (emulsifiers) are surface active agents which foster the development of oil/water emulsion. They may be ionic or nonionic in nature and are typically mixed with stabilizers, to preserve the emulsion formed, and solvents for cold weather use when surfactant viscosity is reduced. A typical dispersant is about 70-80% solvent, 10-15% surfactant and 10-15% stabilizer.

The use of dispersants exposes a great surface area for microbiological attack. However, many

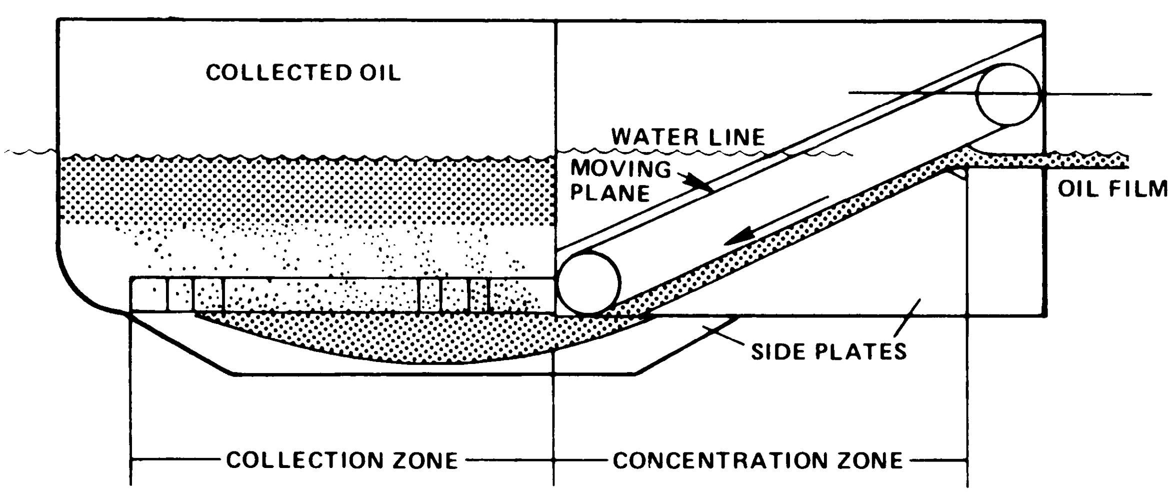

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Figure 8-4.—Principle of Operation of Dynamic Inclined Plane (DIP) Skimmer.

of the surfactants are not degradable; and they, or the materials with which they are mixed, may be toxic to microorganisms and aquatic species. By dispersing, they distribute the oil throughout the water column, extend its area of influence considerably, and have a resultant adverse biological impact. Also, dispersant may have a short effectiveness period; and the oil is released and resurfaces. In fact, dispersion is not really a removal method but rather one of spreading the oil and reducing its visibility.

2. Sinking Agents. Sinking agents are materials such as clay, fly ash, sand, or crushed stone which when applied to spilled oil will sink it. Sunken oil will cover and smother or taint the bottom (benthic) organisms, including shellfish. Additionally, it will move and resurface as a result of turbulence or microbial degradation. For this reason the use of sinking agents is prohibited by Federal regulations.

3. Gelling Agents. These materials absorb, congeal, entrap, and fix the oil to form a semi-rigid or gelatinous mass, which may be more easily recovered, or will inhibit the spread of the spill. Gel agents include soap solution, wax, fatty acids, and various polymers.

4. Burning Agents. The loss of volatile components and the incorporation of water make oil spills difficult to ignite and sustain in the burning condition. The use of burning agents is essential if burning is to be pursued, and approved, as a disposal means. These agents contain combustion promoting and sustaining chemicals. Their use may be authorized by the OSC when it will prevent or substantially reduce hazard to life or property. Such instances are rare in inland waters, and burning should be avoided.

DISPOSAL.—As oil is recovered from the spill area, it must be pumped to a storage area or container where oil/water separation is initiated or continued. Gravity separation, centrifugation, and other separation techniques are available in commercial equipment. The concentrated oil is then removed to transport facilities and conveyed to recycle or disposal sites.

Once oil has been removed from the spill site, the major battle may have been won; but the conflict goes on, because unless the oily waste or oiled debris is properly disposed of by the Navy activity or contract operator, it can and will become a problem at the disposal site. The conventional disposal methods listed in Table 8-2, for example, may allow the oil to recontaminate surface or ground waters, degrade the air quality, or present fire hazards. Damages resulting from any unauthorized disposal of oil by the Navy or its contractor may lead to litigation.

The disposal options are essentially limited to (1) reuse; (2) disposal by soil cultivation techniques; (3) controlled burning; or (4) placement in "approved" sanitary landfills.

Reuse of the oil collected from the spill is to be preferred where it is possible. The recovered oil may be "re-refined" and recycled for beneficial use. Re-refining facilities are not always readily accessible from spill sites, but the possibility of reuse should always be considered.

MITIGATION.—Oil spills will affect the beneficial uses of the water or land with which they have contact. Mitigation deals with the removal of oil from the area to the degree necessary to permit resumption of the original use of the water or area.

Mitigation operations are response actions which may not involve much removal of the pollutant, but are desirable to lessen the impact of the spill.

Restoration activities may include shoveling up asphaltic or tarry residues of the spill; application of hot water washes on rocky shorelines; extensive manual or mechanized efforts to collect, reclaim, and reestablish affected beach sand; or trenching of estuaries to remove as much oil as possible. Most restoration efforts deal with beach areas, where the procedures selected vary with the type, age, and amount of spilled oil and the type of beach affected. Generally, lighter oils (less viscous) penetrate the sand more rapidly, and require the use of techniques that include harrowing in sorbent material to foster degradation, sand pickup, reclamation and/or replacement. Treatment of beach sand to remove oil can only be justified where beach sand is scarce and its

Table 8-2.—Summary of Spilled Oil Disposal Techniques

Disposal Technique	Equipment Required	Advantages	Disadvantages	Comments
Controlled Burning	Incinerator and appropriate feed/storage device.	Good volume reduction with a small amount of inert ash for disposal.	Could be the cause of smoke, odor and particulate emissions.	May need air pollution control system. May be used beneficially in fire-fighting training.
Open Burning	A method of land application (pumps, nozzles, hoses, etc.).	Very economical and simple in its concept and operation.	Will create air pollution, especially smoke. May be a safety problem.	Should not be considered except under favorable meteorological conditions and when there is no other choice.
Sanitary Land Fill	Approved land area. Earth moving equipment.	Satisfactory disposal method.	May create safety hazard. May cause a leachate problem.	May not be acceptable, in many areas, to regulatory officials.
Burial	Acceptable land area. Earth moving equipment.	Simple technique. Economical disposal method.	May create a leachate problem.	Subject to regulatory control.
Land Spreading	Method of land application (pumps, nozzles, hoses, etc.).	Very inexpensive. Very simple.	Safety and fire hazard.	Subject to regulatory approval.

replacement is costly, because the current methods for beach sand reclamation are very expensive.

Mitigation of impacts may also involve biological reseeding of areas affected by the spill or the cleanup operations. It may also include the collection, cleanup, and care of oil soaked birds, which were attracted to the spill area, although this effort is generally only partially effective. It requires expert knowledge, facilities for recuperation, and extensive use of manpower.

As you read earlier in this chapter there are six operational phases involved with spills. We have briefly discussed only four of these. For more detailed information about the phases discussed and additional information on the care of the equipment and administrative follow up to a spill read and study NAVFAC P-908, Oil Spill Control for Inland Waters and Harbors.

CAUSES OF OIL SPILLS

The frequency of occurrence and the volume of oil spilled in relation to the various causes as reported to, and compiled by, the Navy Environmental Support Office (NESO) is shown in table 8-3. You can clearly "see" that human error is involved in the majority of these spills.

The best way to help cope with this problem of "human error" is through the proper training of operational personnel. This should include study of pertinent regulations and operational procedures; adherence to the Personnel Qualification System (PQS) and periodic drills involving cleanup procedures and operation of oil spil1 cleanup equipment.

In addition to routine and schedule maintenance, as well run facility should perform and log periodic inspections dealing with the

Table 8-3.—Navy Related Oil Spills by Cause (1975)

Cause	No. of Spills	Percent Total Spills	Volume Spilled (gal)	Percent Total Vol. Spilled	Av. Vol. of Each Occurrence
Valve misaligned (open)	39	9.4	3,943	3.4	101
Monitoring error	80	19.2	6,792	5.8	85
Donut (WOR)	16	3.8	794	.7	50
Collision	1	.2	1,500	1.3	1,500
Grounding	0	-	-	-	-
Structural/design failure	95	22.8	52,267	44.5	550
Tank overflow	27	6.5	3,305	2.8	122
Fuel transfer (internal)	3	0.7	178	0.1	58
(external)	14	3.4	1,824	1.6	130
Air in line	7	1.7	74	.l	11
Unknown	124	29.7	39,744	33.8	321
Other	11	2.6	7,143	8.1	649

prevention of accidental oil spills. Tanks, pipelines, and valves should be periodically inspected for corrosion. The proper operation and sealing of valves and pumping units are a must.

A daily record of tank levels, and observance of standard operating procedures for many shore facilities and all ships, are effective ways for detecting slow leaks before a major equipment failure occurs. Hydrostatic testing of hoses, pipelines and storage tanks should be performed periodically to verify their use for oil service. Operating personnel should be encouraged to report unsafe conditions in equipment or procedures. Another good practice is to report and document causes of oil spill "near misses" so that preventive action can be initiated. All inspections and records should be in accordance with established written procedures and should remain on file for the use of new personnel and for the identification of deteriorating trends in equipment.

The Navy is expending time, money, and effort to reduce environmental pollution. Therefore, close supervision must be exercised over all operations involving fuel handling, waste disposal, and use and disposal of toxic materials. Personnel must be aware of pollution problems and the necessity to reduce pollution occurrences. Within one's area of responsibility, regular inspection and monitoring procedures must be conducted to ensure compliance with all applicable regulations and operating procedures for pollution control devices.

You will find more detailed information on oil spills in NAVFAC P-908. This publication will provide you with information about policy, rules, regulations, and procedures for the prevention of oil spills. It will also provide you with information on what type of equipment is used to remove/contain oil spills, what are the procedures for cleaning the equipment, and what procedures to follow when reporting the cost of an oil spill.

COLLECTION, HOLDING, AND TRANSFER SYSTEM

The environmental effects that result from sewage discharges into rivers, harbors, and coastal waters by naval ships are of great concern to the Navy. The Navy is required to control sewage discharges under regulations promulgated by the Secretary of Defense. Navy policies and responsibilities are defined in OPNAVINST 6240.3.

The Navy plans to equip each naval ship with a marine sanitation device (MSD) which will enable a ship to comply with the sewage discharge standards without compromising the ship mission capability.

Sewage discharge regulations do not preclude overboard discharge when an emergency situation exists and when failure to discharge would endanger the health and safety of personnel.

In the past, shipboard sewage has been discharged overboard as a matter of routine. Studies have shown that concentration of sewage in inland waters, ports, harbors, and coastal waters of the United States had detrimental effects on the environment.

In 1972, anticipating the present regulations, the CNO made the policy decision to install the Sewage Collection, Holding, and Transfer (CHT) system aboard naval ships which could employ this method of sewage pollution control without serious reduction in military capabilities. The CHT system represented the least cost and risk solution to the problem.

The design goal of the CHT system is to provide the capacity to hold shipboard sewage generated over a 12-hour period. This goal can usually be achieved in large ships. Smaller ships, where the maximum capacity limits holding times to 3 hours or less, which is insufficient time to transit a 3-mile restricted zone, cannot achieve such a goal.

ELEMENTS OF THE CHT SYSTEM

Most operational fleet ships of sufficient size will be equipped with CHT systems. This system is designed to accept soil drains from water closets and urinals and waste drains from showers, laundries, and galleys. As the name of the system implies, sewage collection, holding, and transfer are three functional elements which constitute the CHT system.

Collection Element

The collection element consists of soil and waste drains with diverter valves. Depending on the position of the diverter valves, the soil or waste can be diverted overboard or into the CHT tank. The basic CHT system concept requires that waste drains be kept separate from soil drains wherever practical until they reach their respective overboard diverter valves. Downstream of their overboard diverter valves both waste drains and soil drains may be combined into a single drain line. All drains above the waterline may be diverted overboard by gravity. Drains located below the waterline cannot be diverted directly overboard and must use the CHT system as an ejection system. In this case, the CHT system must operate continuously in all modes.

All drain piping is pitched to insure rapid and complete drainage. Pitch is 1/4-inch/ft whenever possible, but not less than 1/8-inch/ft relative to the operating trim.

Garbage grinder drains connected to the waste drains are installed with a minimum slope of 3 inches/ft. Garbage grinder drains are also provided with a check valve to preclude back-flow from the waste drain and a diverter valve to permit drainage to either the CHT tank or overboard. When the garbage grinder employs seawater for flushing, the waste piping downstream of the garbage grinder is of copper-nickel alloy.

Plumbing drains may penetrate watertight bulkheads. Usually, each bulkhead penetration below flooding water level (FWL-1) is provided with a bulkhead stop valve. The stop valve is a round, full-port plug or ball valve. The stop valve is operable at the valve and the damage control deck. In some installations, diverter valves (3-way valves) are used to prevent progressive flooding throughout the CHT system drains, eliminating the need for a bulkhead stop valve.

Where CHT system valves are designated as damaged control closures, the valve bonnet and hand wheel is labeled SET X-RAY, SET YOKE, or SET ZEBRA, with the direction to be turned marked with an arrow. Similar labeling is required at the damage control deck box. The damage control labeling is in addition to the CHT classification and label plate.

Holding Element

The CHT tank is usually sized for a 12-hour holding period. Individual ship constraints may affect this design objective. Each tank has inside surfaces which are usually free of structural members such as stiffeners, headers, and brackets. Very large tanks may require swash bulkheads to dampen movement of the tank contents. The tank bottom slopes approximately 1.5 inches/ft toward the pump section. All internal surfaces of the tank are coated in accordance with procedures given in the Naval Ship's Technical Manual chapter 63(9190). Preservation of Ships in Service, for protecting sanitary tanks, and to prevent corrosion. Each CHT tank is fitted with a vent to the atmosphere and an overflow to the sea. In addition, a manhole is provided for internal maintenance. Vents should be positioned to avoid intake of CHT gases into the air compressor or ventilation intakes.

Transfer Element

Each tank is equipped with two nonclog marine sewage pumps connected in parallel. The pumps may discharge sewage to a tender, barge, shore facility, or directly overboard, depending on the position of the discharge diverter valve. Each pump is equipped with full-port plug or ball suction and discharge valves, and a discharge swing check valve with a hold-open device. An explanation of pump characteristics curves is given in Naval Ships' Technical Manual, Chapter 503(9470), Pumps.

System Types

Two types of CHT systems are installed. The type selected for a particular ship depends on the holding tank capacity. Systems with tanks with a capacity of more than 2000 gallons use a comminutor and aeration system. Smaller systems with tanks having a capacity of less than 2000 gallons use strainers.

Comminutor

In a comminutor-type system the comminutor located in the soil drain or the combined soil and waste drain serves to macerate solids passing into the CHT tank. A bypass is fitted upstream of the comminutor. If the comminutor jams or plugs, the bypass provides drainage around the comminutor and into the tank. If a valve is fitted in the bypass, it should always remain open. Isolation valves are fitted directly before and after the comminutor to allow for maintenance. Most installations include an access port, or cleanout, to permit removal of foreign objects which may jam or plug the comminutor. The components of the comminutor-type system, shown in figure 8-5, include:

1. The CHT tank. The capacity of each tank usually is more than 2000 gallons.

2. The CHT pump set; one pump set per tank. A pump set consists of two motor-driven pumps, two suction plug or ball valves, two discharge plug or ball valves, two discharge check valves (with hold-open device), a pump controller, a high level alarm, and an appropriate number of liquid level sensors.

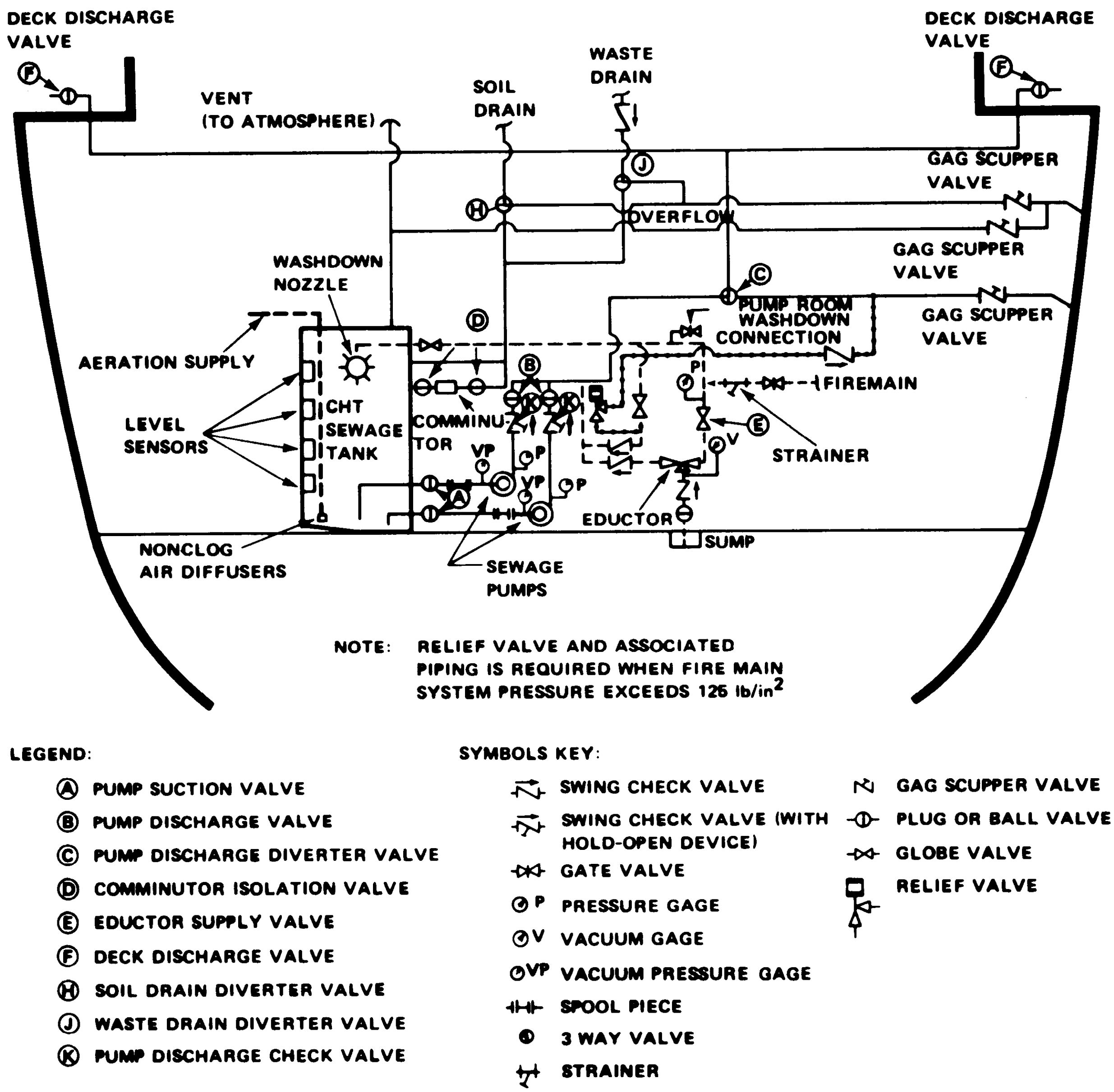

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Figure 8-5.—Comminutor type CHT system.

3. The comminutor. One comminutor is located in each soil drain or combined drain entering each tank.
4. The aeration supply system.
5. The firemain flushing connections and spray cleaning nozzle for tank washdown.
6. The piping, valves, and fittings.

Strainer

The strainer-type system incorporates an overflow strainer within the CHT tank and an inflow strainer mounted on the discharge side of each pump. The drain collection piping directs sewage flow through the overflow strainer where liquids may overflow into the CHT tank if the inflow strainer or the pumps become clogged. Solid and liquid wastes flow through the ball or plug valve and the check valves until they reach the pump discharge piping. At this junction, the sewage flow passes through the inflow strainer where large solids are collected, then through the pumps, and back into the CHT tank. The inflow strainer limits the flow of solids, but liquids are allowed to pass through the pump into the tank. Each time the pump operates, its inflow strainer is cleaned by the reverse flow of liquid being pumped from the tank. The strainer-type system components, shown in figure 8-6, include:

1. The CHT tank. The capacity of each tank usually is less than 2000 gallons.
2. The CHT pump set; one pump set per tank. A pump set consists of two motor-driven pumps, two suction plug or ball valves, two discharge plug or ball valves, two discharge check valves (with hold-open device), a pump controller, a high level alarm, and an appropriate number of liquid level sensors.
3. The Firemain flushing connections and spray cleaning nozzle for tank washdowns.
4. The piping, valves, and fittings.

CHT OPERATIONAL MODES

The CHT system can be used in any of three district modes of operation in accordance with any one of the following situations:

1. Transiting Restricted Zones. When transiting restricted zones, the CHT system must be set up to collect and hold the discharges from soil drains only.
2. In Port. During in-port periods, the CHT system collects, holds, and transfers to shore sewage facility all discharges from soil and waste drains.
3. At Sea. When operating at sea outside restricted areas, the CHT system is set up to divert discharges from both soil and waste drains overboard.

Transmit Mode

While transiting a restricted zone, soil drains are routed to the CHT tanks and the waste drains are diverted overboard. Both CHT pump controller switches are in the OFF position. Pump suction valves A and inflow stop valve G (for strainer system only). are open (see figure 8-6). Pump discharge valves B and the tank washdown supply valve are closed. Soil drain diverter valves H are in the CHT COLLECTION position. Waste drain diverter valves J are in the OVERBOARD position, discharging through the gag scupper valves.

For systems equipped with a comminutor (see figure 8-5) and an aeration system (see figure 8-7), open the comminutor isolation valves, D and operate the comminutor. The tank contents must be aerated continuously. Operate the air blower and open discharge valve M (shown in figure 8-7). Air also can be supplied by opening the ship service air supply valve N (also shown in figure 8-7). If an aspirator system is employed, the aspirator pump should be activated.

WARNING

Whenever a high level alarm sounds, immediate action must be taken to close the isolation valves on drains below the overboard discharge and to divert upper level drains overboard to preclude flooding of spaces.

After sewage transfer hose connections are completed, both soil and waste drains are routed to the CHT tank and then discharged to a shore receiving facility, nested ship, or barge receiving station. When connecting the sewage transfer hose, proper chafing gear and supporting lines

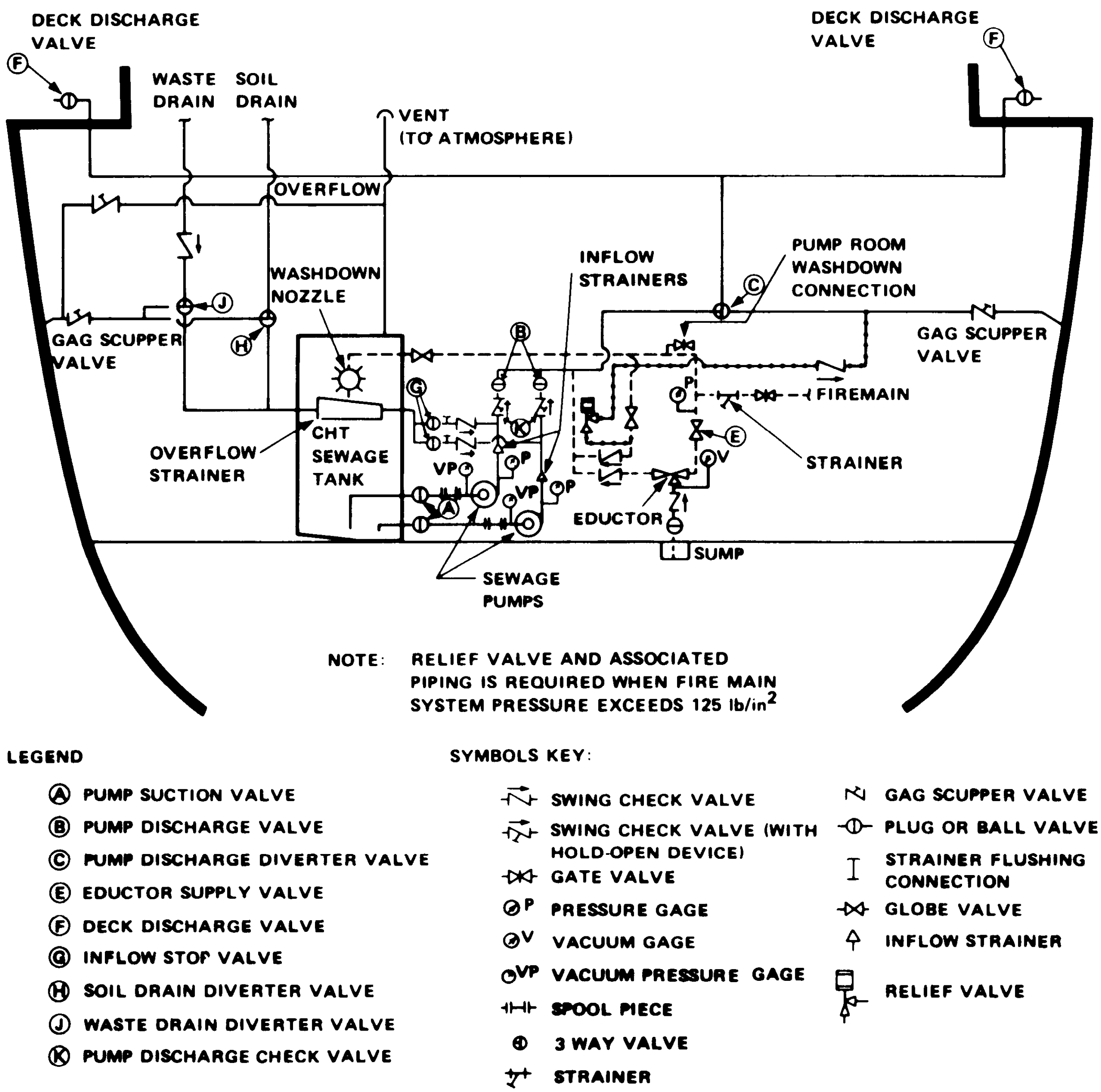

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Figure 8-6.—Strainer-type CHT system.

should be fitted where required to protect the hose. Care should be taken to prevent the hose from snagging between the ship and the pier.

Valves A, B, and C should be lined up and set for discharge to the shore side deck discharge at valve F. The receiving station sewer valve should then be opened, followed by valve F at the deck connection. With a person stationed at deck connection F, pass the word to the CHT pump room that hose connections have been made (see figures 8-5 and 8-6).

Set both pump controller selector switches to AUTO position. Set soil drain diverter valves H and waste drain diverter valves J to the CHT COLLECTION position for drainage to the CHT tank. After the tank is pumped down and the

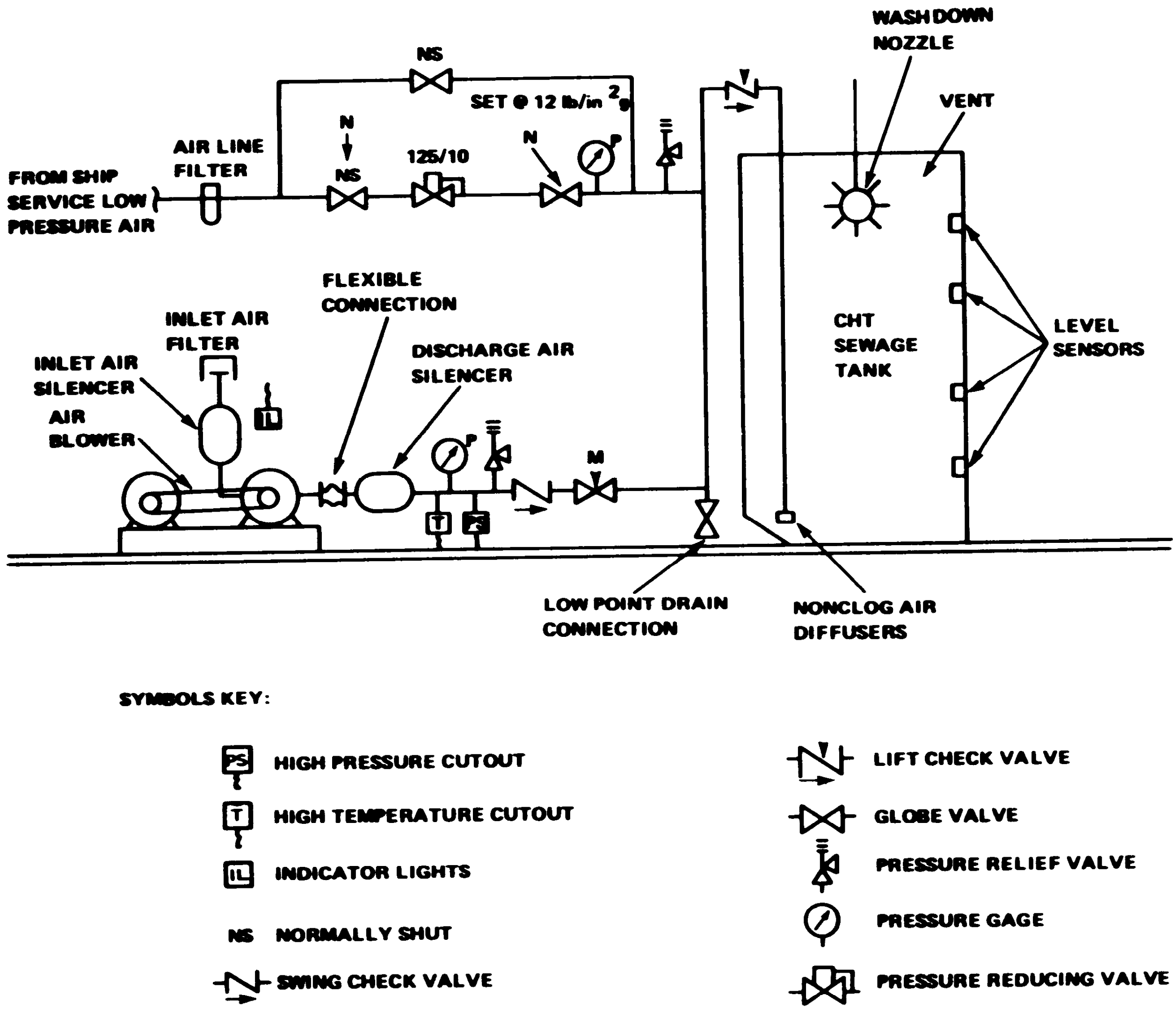

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Figure 8-7.—Aeration subsystem.

pump stops, open the tank washdown supply valve and wash the tank for 30 minutes. Close the tank washdown supply valve.

The comminutor and aeration system should be operated continuously in the in-port mode. During extended in-port transfer operations, the CHT tank must be washed a minimum of 30 min/wk. While discharging waste through transfer hoses, check periodically for leakage, kinking, and snagging.

In the event of a high level alarm, the operator should recognize that a problem exists with the pumps, the discharge piping, or both. If the tank completely fills while the system malfunction is being investigated, the waste will overflow overboard and through any heads or fixtures located below the overflow discharge lines. Drain lines from these fixtures incorporate both a check valve and an isolation, or cutoff, valve. These fixtures must be identified prior to initial system use. Whenever a high level alarm sounds, immediate action must be taken to close the isolation valves on drains located below the CHT tank overflow line discharge and divert upper deck drains overboard to preclude flooding of space. In the event of leakage or snagging of the transfer hoses, close valve F (shown in figures 8-5 and 8-6) at the deck connection only (closure of pier valve may cause the discharge hose to rupture). Line up pump discharge diverter valve C for overboard discharge, to prevent overflow or backup of drains located below the tank overflow.

At-Sea Mode

In order to set the CHT system up for the At-sea mode (refer to figures 8-5 and 8-6) set soil and waste drain diverter valves H and J to the OVERBOARD position. Open pump discharge valves B and set pump discharge diverter valve C to the overboard position. Check to insure that gag scupper valve at the hull in the pump discharge line is open. Set the discharge pump controller selector switches to the MAN1 position. After the pumps lose suction, set both controller selector switches to the AUTO position. Open the tank washdown supply valve and wash the tank for 30 minutes. Close the tank washdown supply valve. Set the controller selector switches to MAN1 position. After loss of pump suction, set controller switches in the OFF position. Close pump suction valves A, discharge valves B, and, in the strainer system only, close the inflow stopvalves G.

For CHT systems outfitted will comminutors and aeration systems, secure the comminutor after setting the soil drain diverter valves. Close air blower discharge valve M and secure air blower, or close ship supply valve N after tank washdown procedures have been completed and the pump has lost suction. If an air aspirator system is installed, shut the system down and secure the aspiration pump.

The CHT system is now secured with all soil and waste being discharged overboard through the gravity drainage system.

For additional information on the CHT system and its components, refer to the manufacturer's technical manuals and Naval Ships' Technical Manual, Chapter 593.

NOISE POLLUTION

Hearing loss problems have been and continue to be a source of concern within the Navy, both ashore and afloat. In the Navy the loss of hearing can occur from exposure to impulse or blast noise (i.e., gunfire, rockets, etc.) or from continuous or intermittent sounds such as jet or propeller aircraft, marine engines, boiler equipment operations, and any of a myriad of noise sources associated with industrial type activities (such as shipyards). Hearing loss may be temporary, and will disappear after a brief period of nonexposure, or it may become permanent through repeated exposures to intense noise levels. The loss of hearing sensitivity is generally in the higher frequencies of 4000-6000 Hertz (Hz) with many people sustaining extensive impairment before the all important speech range of 500-3000 Hz is appreciably affected.

The Navy recognized noise pollution to be a problem and started to combat it through the Hearing Conservation Program. The main purpose of this program is to establish and implement an effective occupational noise control and hearing conservation program which has as its goal the elimination/prevention of hearing loss.

HEARING CONSERVATION PROGRAM

Hearing loss associated with exposure to hazardous noise and the high cost of compensation claims have highlighted a significant problem which requires action to reduce or eliminate hazardous occupational noise levels. An effective occupational noise control and hearing conservation program will prevent or reduce the exposure of personnel to potentially hazardous noise. Such programs will incorporate the following elements:

1. Identification of hazardous noise areas and their sources.
2. Elimination or reduction of noise levels through the use of engineering controls.
3. Periodic hearing testing of noise-exposed personnel to evaluate program effectiveness.
4. Education of all hands in the command's program and their individual responsibilities.
5. Strict enforcement of all prescribed occupational noise control and hearing conservation measures including disciplinary action for violators and supervisors, as necessary.

RESPONSIBILITIES

The Secretary of the Navy policy, contained in SECNAVINST 5100.1D, emphasizes that occupational safety and health are the responsibilities of all commands. Accordingly, the following actions and responsibilities are assigned.

Bureau of Medicine and Surgery

The Chief, Bureau of Medicine and Surgery (CHBUMED) shall manage the hearing conservation program and maintain the program's currency and effectiveness. It must provide audiometric support to all military and civilian personnel who are included in a hearing conservation program, professional and technical assistance to commands responsible for assuring that the hearing of military and civilian personnel is protected, and appropriate professional and technical hearing conservation guidance and assistance to the Chief of Naval Education and Training (CNET).

It must develop guidelines and issue certifications in accordance with OPNAVINST 6260.2 Enclosure (1) for personnel conducting sound level measurements, (2) personnel performing hearing conservation audiometry, (3) audiometric test chambers, (4) audiometers, and (5) all sound level measuring equipment, and it must support a research and development effort in medical aspects of hearing conservation to insure existing technology represents the most advanced state-of-the-art.

Chief of Naval Material

The Chief of Naval Material (CHNAVMAT) shall in coordination with CHBUMED, provide technical assist and and engineering guidance to commands as delineated in OPNAVINST 6260.2 and periodically update to maintain currency and effectiveness. It shall insure, consistent and required military capabilities, that noise abatement is considered, designed, and engineered into all (both existing and future) ships and aircraft, weapons and weapon systems, equipment, materials, supplies, and facilities which are acquired, constructed, or provided through the Naval Material Command; and it shall provide appropriate technical and engineering control methodology guidance and assistance to CNET.

The Chief, Naval Education and Training

The Chief, Naval Education and Training (CNET) shall, with the assistance of CHBUMED and CHNAVMAT incorporate hearing conservation and engineering control guidance information in the curricula of all appropriate training courses. It shall provide specialized hearing conservation and engineering control training and education as required, and serve as the central source for the collection, publication and dissemination of information on specialized hearing conservation and engineering control training courses.

Naval Inspector General

The Naval Inspector General (NAVINSGEN) shall evaluate hearing conservation and engineering control procedures during conduct of the Navy's Occupational Safety and Health Inspection Program (NOSHIP) oversight inspections of activities ashore.

President, Board of Inspection and Survey

The President, Board of Inspection and Survey (PRESINSURV) shall be directly responsible for oversight inspection aspects of shipboard hearing conservation and engineering control compliance. Inspections of fleet units shall be incorporated into existing condition inspection programs.

Commander, Naval Safety Center

The Commander, Naval Safety Center (COMNAVSAFECEN) shall provide program evaluation, as requested, provide program promotion through NAVSAFECEN publications, and review program compliance during the conduct of surveys.

Fleet Commander in Chief

Fleet Commanders in Chief and other major commanders, commanding officers, and officers in charge shall insure that all Navy areas, worksites, and equipment under their cognizance are identified as potentially hazardous and labeled in accordance with OPNAVINST 6260.2 where noise levels are 85 dBA or greater or where impulse or impact noise exceeds a peak sound pressure level of 140 dB. Where necessary, surveys shall be conducted in compliance with the guidance outlined in OPNAVINST 6260.2 enclosure (1). Enclosure (3) of OPNAVINST 6260.2 provides a listing of activities where industrial hygiene assistance may be obtained.

Where a potential noise hazard has been identified, a hearing conservation program shall be instituted in accordance with OPNAVINST 6260.2 and a roster will be maintained on personnel placed in the program. Noise levels will be eliminated or reduced through the use of engineering controls.

Personal hearing protective devices will be provided and used properly by personnel where administrative or engineering controls are infeasible or ineffective. All military civilian personnel whose duties entail exposure to potentially hazardous noise will receive instruction regarding the command occupational noise control and hearing conservation program, the undesirable effects of noise, the proper use and care of hearing protective devices, and the necessity of periodic hearing testing. Emphasis will be placed upon leadership by example as regards the wearing of hearing protective devices. Command policy shall be enforced, including the initiation of disciplinary measures for repeated failure to comply with the requirements of the hearing conservation program.

In addition to the personnel mentioned above, we need to describe the shipboard responsibilities of the Engineer Officer and the work center supervisor.

ENGINEER OFFICER.—OPNAVINST 6260.2 outlines the shipboard program for hearing conservation. Although the medical department representative has primary cognizant over this program there are elements that the engineer officer must monitor and which are subject to periodic review. Periodic surveys must be accomplished to properly identify those areas within the propulsion spaces that fall into the category "Noise Hazardous Area." These areas must be marked and personnel tasked with working in these areas must have available to them and utilize the prescribed aural protective devices. Training and discussion should emphasize the need for wearing these devices and should stress the medical element of hazards to hearing resulting from "non-use." The following paragraphs outline the specific actions to be taken by the engineer officer and subordinates to insure the effectiveness of the command program.

The engineer officer will:

1. Insure that all newly reporting personnel have received a base-line audiogram and that each individual's medical record reflects the results of this examination.
2. Insure that all engineering department personnel receive an annual re-examination by a medical activity.
3. Advise the medical department representative, by memorandum, of personnel by name who are working or stand watches in areas determined to be "high noise areas" and defined in OPNAVINST 6260.2.
4. Arrange for a noise survey to be taken initially by an industrial or IMA activity, and insure that surveys are retaken at least annually.
5. Designate "high noise areas" from the survey and insure that areas are properly marked or labeled with prescribed markings. Advise the medical department of areas so designated and of any changes that may occur.
6. Insure aural protective devices to all personnel tasked to work in designated "high noise areas." These devices will be made available through the medical department for individual fitting and issue. Issue of these devices will be recorded in the individuals' medical records.
7. Insure that sufficient training is provided to operating personnel concerning the hazards and preventive elements of the program, stressing the use of available protective devices.
8. The main propulsion assistant should be designated as the department officer to monitor and assist the engineer officer in all elements of the program.

WORK CENTER SUPERVISOR.—As a work center supervisor you are responsible for ensuring that safety signs are posted in your spaces which are high noise areas, that your personnel are trained and counseled as to the effects of noise pollution, and that they have the proper hearing protection as required for that area.

For additional information on the Hearing Conservation Program refer to OPNAVINST 6260.2.